Pediatric Obesity

Nicole Greenwood, M.D.

Assistant Professor of Pediatrics LECOM

Objectives

- Understand obesity/overweight definition
- Understand medical consequences
- How to better evaluate and manage obese/overweight pediatric patients

Obesity

- Obesity is a growing epidemic for past few decades
- Affects more than 34% American children
- Top threat due to morbidity and mortality associated
- Medical consequences of obesity accounted for 40% of health-care budget by 2006
- $147 billion spent in health-care spending alone in 2008
- For pediatric population with elevated BMIs ages 6-19, total additional

Pediatric Obesity

- Pediatric obesity affects all organ systems
- Type 2 diabetes in 9-year-olds
- Bariatric surgery

  -BMI greater than or equal to 35kg/m^2

  -Physical maturity (completing 95% of predicted adult stature based on bone age or reaching tanner IV)

  -History of sustained efforts to lose weight

Pediatric Obesity

- Obesity = energy in exceeds energy out

- In United States children are:
  - obese if BMI exceeds 95th percentile for age
  - overweight if BMI falls within 85th to 95th percentile range for age

Pediatric Obesity

- To track – use WHO's downloadable growth charts birth through 23 months

- Use CDC BMI graphs for children 2 and up

Pediatric Obesity

- **Use and Interpretation of the WHO and CDC Growth Charts for Children from Birth to 20 Years in the United States**
- **CDC Recommendation**
- Use the WHO growth charts for all children from birth up to 2 years of age to monitor growth in the United States. The WHO growth standards for children younger than 2 years have been adapted for use in the United States.*
- Use the CDC growth charts for children and teens aged 2 through 19 years to monitor growth in the United States.*

- **Background**
- The WHO growth charts are international standards that show how healthy children should grow. The standards describe the growth of children living in six countries (including the United States) in environments believed to support optimal growth. One of the several criteria defined for optimal growth is breastfeeding. The WHO growth charts use the growth of breastfed infants as the norm for growth. This is in agreement with national guidelines that recommend breastfeeding as the optimal infant feeding method. The WHO growth charts should be used with all children up to aged 2 years, regardless of type of feeding.
- The CDC growth charts are a national reference that represent how US children and teens grew primarily during the 1970s, 1980s and 1990s. The CDC recommends using the references from ages 2 through 19 years so health care providers can track weight, stature, and body mass index (BMI) from childhood through age 19 years.

Pediatric Obesity

- Prevalence of pediatric obesity increased especially in developed countries

- Prevalence tripled ages 6-19 (2003-2006)

- Why?

  -Prenatal influences i.e. food milieu by placenta

  -Prenatal nutritional deprivation, GDM, high birthweight correlates with obesity

Pediatric Obesity

- Protective factors:
  - breastfeeding
  - active lifestyles,
  - minimal TV
  - non-obese parents

Pediatric Obesity

- 14% chance if obese as infant
- 25% if obese as preschool age child
- 41% chance if obese at age 7
- 75% chance is obese at age 12
- 90% if obese in adolescence

Pediatric Obesity

- Not just genes

    -Exogenous influences like family dinner demise (food on the run)

    -Prepackaged foods high ratios of saturated fat and high-fructose corn syrup

    -Less accessible and lower intake of fruit and vegetables

    -Lack of safe areas to play outside

    -Cultural – what does food represent?

Pediatric Obesity

- "obesity itself cannot be considered an illness"

- Will pay for adult coronary bypass as opposed to funding treatment for obese patients who don't have this comorbidity yet

Pediatric Obesity

- What are these medical consequences?
-         HTN (2.9 times higher in obese children and teens)
-         Type 2 Diabetes (2.9 times higher in obese children and teens)
-         Coronary artery disease
-         Hypercholesterolemia (2.1 times higher)
-         Other hyperlipidemias
-         LFH
-         Obstructive sleep apnea
-         Worsening of asthma
-         Stress joints
-         Blount disease
-         Pseudotumor cerebri
-         Hepatic steatosis, cholelithiasis
-         GER
-         Insulin resistance, acanthosis nigricans
-         Depression

Pediatric Obesity

- All this talk sounds like Metabolic Syndrome (MetS)…in kids?
- But there is no MetS definition in children, why?

   -lack of unifying definition in adults

   - increase in insulin resistance during puberty

   -Lipid profiles change by age

   -lack of consensus on waist circumference

Pediatric MetS?

- <u>6-<10 YEARS</u>
  - Cannot diagnose in this age group

- <u>10-<16 YEARS</u>
- • Obesity ‡90th percentile by waist circumference
- • 2 or more of the following:
- Fasting glucose >100 mg/dL (5.6 mmol/L) or known type 2 diabetes
- SBP ‡130 mm Hg or DBP ‡85 mm Hg
- Fasting TG ‡150 mg/dL (1.7 mmol/L)
- HDL <40 mg/dL (1.0 mmol/L)
- Central obesity: waist circumference >94 cm (men) or >80 cm (women)

- <u>>16 years</u>
- • 2 of the following:
- Fasting glucose >100 mg/dL (5.6 mmol/L) or previously diagnosed type 2 diabetes
- SBP ‡130 mm Hg or DBP ‡85 mm Hg or treatment for hypertension
- Fasting TG ‡150 mg/dL (1.7 mmol/L) or treatment for hyperlipidemia
- HDL <40 mg/dL (1.0 mmol/L) (men) or <50 mg/dL (1.3 mmol/L) (women) or treatment for hyperlipidemia

Pediatric MetS

- What we do know about MetS development in Pediatrics to Adulthood:
  - Insulin resistance plays key role in its development
  - Children with parents are at higher risk for developing it
  - In adolescence, gender plays a role male>female
  - Higher in Hispanics

Pediatric MetS

- What we do know about MetS development in Pediatrics to adulthood:
  - Increased TV watching as child (decrease in insulin sensitivity in skeletal muscle that can be regained with the resumption of physical activity.)
  - NAFLD
  - Early and late menarche
  - High Fructose consumption

Pediatric Obesity

- Obesity in the pediatric patient and MetS

- We know how to define obesity, but is there more to it?
  - Fat distribution
  - Visceral fat accumulation independent of BMI

Pediatric Obesity and Dyslipidemia

- Dyslipidemia in children increase in TG and decrease in HDL

- Insulin resistance and resultant hyperinsulinemia stimulates TG production

Lipid Screening

- 0-2 years
  - No universal lipid screening
- 2-8years, 12-16years
  - No universal screening
  - Measure fasting lipid profile twice (2 weeks – 3 months apart) and average if:
  - Parent, grandparent, aunt/uncle or sibling with
    - MI, angina, stroke CABG/stent/angioplasty at <55 in males <65 females
    - Parent with TC >240 mg/dl or known dyslipidemia
    - Parent with TC >/ 240mg/dl or know dyslipidemia
    - Child has diabetes, hypertension, BMI>/ 95th percentile or smokes cigarettes
    - Medical condition: T1/T2 diabetes, CKD, ESRD, post-renal transplant, kawasaki disease with current/regressed aneurysm, heart transplant, chronic inflammatory disease, HIV, nephrotic syndrome
- 9-11years, 17-21years
  - Universal screening

Pediatric Obesity and Dyslipidemia

Category	Acceptable	Borderline	High
TC	<170	170-199	>/200
LDL-C	<110	110-129	>/130
Non-HDL-C	<120	120-144	>/145
TG			
0-9 years	<75	75-99	>/100
10-19years	<90	90-129	>/100
HDL-C	>45	40-45	<40

Pediatric Obesity and Dyslipidemia

- Pediatrics
- December 2011, VOLUME 128 / ISSUE Supplement 5
- From the American Academy of Pediatrics
- SUPPLEMENT ARTICLE
- **Expert Panel on Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and Adolescents: Summary Report**
- EXPERT PANEL ON INTEGRATED GUIDELINES FOR CARDIOVASCULAR HEALTH AND RISK REDUCTION IN CHILDREN AND ADOLESCENTS

Pediatric Obesity and Dyslipidemia
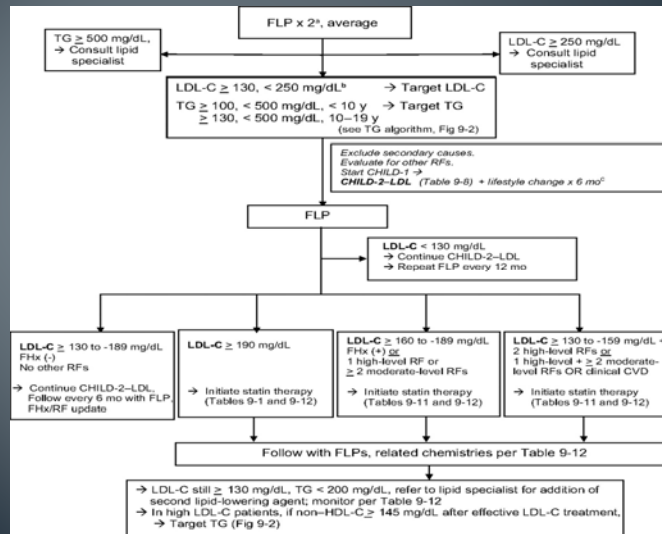
RF Definitions for Dyslipidemia Algorithm

Positive family history: myocardial infarction, angina, coronary artery bypass graft/stent/angioplasty, sudden cardiac death in parent, grandparent, aunt, or uncle at <55 y for males, <65 y for females

High-level RFs

Hypertension that requires drug therapy (BP ≥ 99th percentile + 5 mm Hg)

Current cigarette smoker

BMI at the ≥97th percentile

Presence of high-risk conditions (Table 9-7)

(DM is also a high-level RF, but it is classified here as a high-risk condition to correspond with Adult Treatment Panel III recommendations for adults that DM be considered a CVD equivalent.)

Moderate-level RFs

Hypertension that does not require drug therapy

BMI at the ≥95th percentile, <97th percentile

HDL cholesterol < 40 mg/dL

Presence of moderate-risk conditions (Table 9-7)

Pediatric Hypertension New Guidelines 2017

American Academy
of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

Clinical Practice Guideline for
Screening and Management
of High Blood Pressure in
Children and Adolescents

Joseph T. Flynn, MD, MS, FAAP,[a] David C. Kaelber, MD, PhD, MPH, FAAP, FACP, FACMI,[b] Carissa M. Baker-Smith, MD, MS, MPH, FAAP, FAHA,[c] Douglas Blowey, MD,[d] Aaron E. Carroll, MD, MS, FAAP,[e] Stephen R. Daniels, MD, PhD, FAAP,[f] Sarah D. de Ferranti, MD, MPH, FAAP,[g] Janis M. Dionne, MD, FRCPC,[h] Bonita Falkner, MD,[i] Susan K. Flinn, MA,[j] Samuel S. Gidding, MD,[k] Celeste Goodwin,[l] Michael G. Leu, MD, MS, MHS, FAAP,[m] Makia E. Powers, MD, MPH, FAAP,[n] Corinna Rea, MD, MPH, FAAP,[o] Joshua Samuels, MD, MPH, FAAP,[p] Madeline Simasek, MD, MSCP, FAAP,[q] Vidhu V. Thaker, MD, FAAP,[r] Elaine M. Urbina, MD, MS, FAAP,[s] SUBCOMMITTEE ON SCREENING AND MANAGEMENT OF HIGH BLOOD PRESSURE IN CHILDREN

Pediatric Hypertension

- Hypertension – one of the most modifiable risk factors for CVD
- Strong link between pediatric HTN and adult MetS
- New HTN guidelines in Pediatrics:
- Pre-HTN is replaced by Elevated Blood Pressure
- Children 13 years and older use adult ranges

Pediatric Hypertension

For Children Aged 1–13 y	For Children Aged ≥13 y
Normal BP: <90th percentile	Normal BP: <120/<80 mm Hg
Elevated BP: ≥90th percentile to <95th percentile or 120/80 mm Hg to <95th percentile (whichever is lower)	Elevated BP: 120/<80 to 129/<80 mm Hg
Stage 1 HTN: ≥95th percentile to <95th percentile + 12 mmHg, or 130/80 to 139/89 mm Hg (whichever is lower)	Stage 1 HTN: 130/80 to 139/89 mm Hg
Stage 2 HTN: ≥95th percentile + 12 mm Hg, or ≥140/90 mm Hg (whichever is lower)	Stage 2 HTN: ≥140/90 mm Hg

Pediatric Hypertension

TABLE 6 Screening BP Values Requiring Further Evaluation

| Age, y	BP, mm Hg			
	Boys		Girls	
	Systolic	DBP	Systolic	DBP
1	98	52	98	54
2	100	55	101	58
3	101	58	102	60
4	102	60	103	62
5	103	63	104	64
6	105	66	105	67
7	106	68	106	68
8	107	69	107	69
9	107	70	108	71
10	108	72	109	72
11	110	74	111	74
12	113	75	114	75
≥13	120	80	120	80

Pediatric Hypertension

- What does this do now?
  - Prevalence elevated BP increased from 11.8% to 14.2%
  - 5.8% have new elevated BP diagnosis

Pediatric Hypertension

- New guidelines
  - Start BP measurement at age 3 ANNUALLY unless risk factors present

- BP should be checked in all children and adolescents ≥3 years of age at every health care encounter if they have obesity, are taking medications known to increase BP, have renal disease, a history of aortic arch obstruction or coarctation, or diabetes

- Trained health care professionals in the office setting should make a diagnosis of HTN if a child or adolescent has auscultatory confirmed BP readings ≥95th percentile* at 3 different visits *≥130/80 in adolescents ≥13 years of age

Pediatric Hypertension
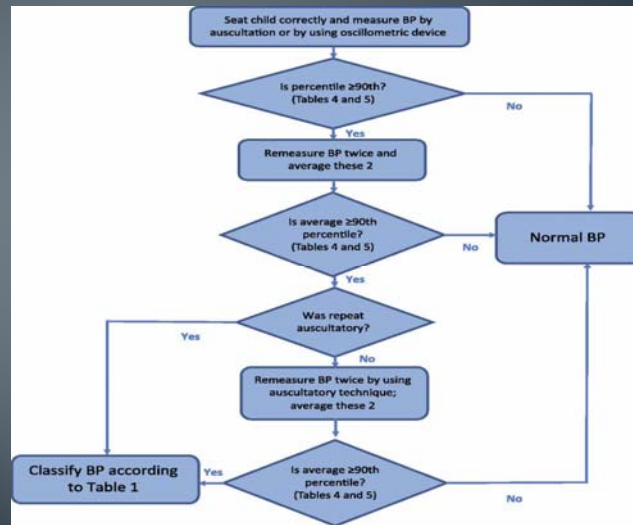
Pediatric Hypertension

BP Category (see Table 3)	BP Screening Schedule	Lifestyle Counseling (Weight, Nutrition)	Check Upper and Lower Extremity BP	ABPM	Diagnostic Evaluation	Initiate Treatment	Consider Sub-specialty Referral
Normal	Annual	X					
Elevated BP	Initial measurement	X					
	Second measurement: Repeat in 6 months	X	X				
	Third measurement: Repeat in 6 months	X		X	X		X
Stage 1 HTN	Initial measurement	X					
	Second measurement: Repeat in 1-2 weeks	X	X				
	Third measurement: Repeat in 3 months	X		X	X	X	X
Stage 2 HTN	Initial measurement	X	X				
	Second measurement: Repeat/refer to specialty care within 1 week	X		X	X	X	X

Pediatric Hypertension

- Children and adolescents ≥6 years of age do not require an extensive evaluation for secondary causes of HTN if they have a positive family history of HTN, are overweight or obese, and/or do not have history or physical examination findings suggestive of a secondary cause of HTN

Pediatric Hypertension

TABLE 10 Screening Tests and Relevant Populations

Patient Population	Screening Tests
All patients	Urinalysis
	Chemistry panel, including electrolytes, blood urea nitrogen, and creatinine
	Lipid profile (fasting or nonfasting to include high-density lipoproteina and total cholesterol)
	Renal ultrasonography in those <6 y of age or those with abnormal urinalysis or renal function
In the obese (BMI >95th percentile) child or adolescent, in addition to the above	Hemoglobin A1c (accepted screen for diabetes)
	Aspartate transaminase and alanine transaminase (screen for fatty liver)
	Fasting lipid panel (screen for dyslipidemia)
Optional tests to be obtained on the basis of history, physical examination, and initial studies	Fasting serum glucose for those at high risk for diabetes mellitus
	Thyroid-stimulating hormone
	Drug screen
	Sleep study (if loud snoring, daytime sleepiness, or reported history of apnea)
	Complete blood count, especially in those with growth delay or abnormal renal function

Pediatric Hypertension

- In children and adolescents being evaluated for high BP, the provider should obtain a perinatal history, appropriate nutritional history, physical activity history, psychosocial history, and family history, and perform a physical examination to identify findings suggestive of secondary causes of HTN

Pediatric Hypertension

- **Neonatal hypertension: an educational review.**
- Harer MW[1], Kent AL[2,3].
- Author information
- 1Department of Pediatrics, Division of Neonatology, University of Wisconsin School of Medicine and Public Health, Madison, WI, USA.2Department of Neonatology, Centenary Hospital for Women and Children, Canberra Hospital, P.O. Box 11, Woden, ACT, 2606, Australia. alison.kent@act.gov.au.3Australian National University Medical School, Canberra, Australia. alison.kent@act.gov.au.

- **Abstract**
- Hypertension is encountered in up to 3% of neonates and occurs more frequently in neonates requiring hospitalization in the neonatal intensive care unit (NICU) than in neonates in newborn nurseries or outpatient clinics. Former NICU neonates are at higher risk of hypertension secondary to invasive procedures and disease-related comorbidities. Accurate measurement of blood pressure (BP) remains challenging, but new standardized methods result in less measurement error. Multiple factors contribute to the rapidly changing BP of a neonate: gestational age, postmenstrual age (PMA), birth weight, and maternal factors are the most significant contributors. Given the natural evolution of BP as neonates mature, a percentile cutoff of 95% for PMA has been the most common definition used; however, this is not based on outcome data. **Common causes of neonatal hypertension are congenital and acquired renal disease, history of umbilical arterial catheter placement, and bronchopulmonary dysplasia.** The treatment of neonatal hypertension has mostly been off-label, but as evidence accumulates, the safety of medical management has increased. The prognosis of neonatal hypertension remains largely unknown and thankfully most often resolves unless secondary to renovascular disease, but further research is needed. This review discusses important factors related to neonatal hypertension including BP measurement, determinants of BP, and management of neonatal hypertension

Pediatric Glucose Intolerance

- Insulin resistance normal reaction of tissues to maintain adequate insulin sensitivity against increased fat deposition
- Impaired fasting glucose: equal to or greater than 100mg/dl but less than 126mg/dl
- Impaired glucose tolerance: 2-hour oral glucose tolerance test greater than or equal to 140mg/dl

Evaluation

All children
• Serum cholesterol assessment once in childhood if family history for hypercholesterolemia, once in adolescence
BMI 85th to 94th percentile
• Fasting lipid panel
• ALT and AST, fasting glucose (Note: complete metabolic panel contains both studies and may be less expensive in certain health-care systems)
• Complete blood count to screen for iron deficiency anemia and other nutritional depletion
BMI >95th percentile
• Fasting lipid panel
• ALT, AST, fasting glucose (complete metabolic panel as above)
• Abdominal ultrasonography to evaluate for fatty liver
• Other laboratory tests, as dictated by the evaluation (e.g., thyroid enlargement, history suspicious for Prader-Willi syndrome, headaches consistent with pseudotumor cerebri)
• Urinalysis to screen for type 2 diabetes

Reducing BMI by 10%

- Potential Results of Reducing BMI by 10%
- Blood pressure decreases by 10mm HG
- Triglycerides decrease below 100mg/dl
- HDL increases by 3-5 mg/dl
- LDL decrease 25-30% if elevated

Treatment

- Treatment needs everyone to be on board, especially parents
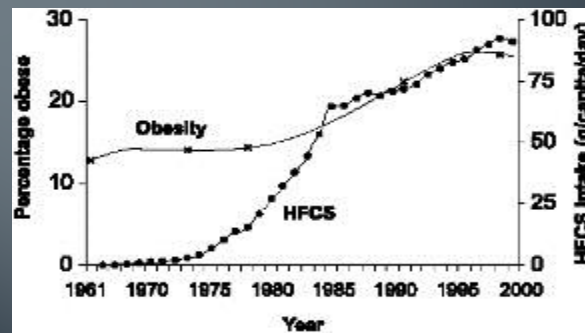- Assess to readiness for change

Treatment

Sucrose, High-Fructose Corn Syrup, and Fructose, Their Metabolism and Potential Health Effects: What Do We Really Know?[1,2]

James M. Rippe[5,*] and Theodore J. Angelopoulos[6]
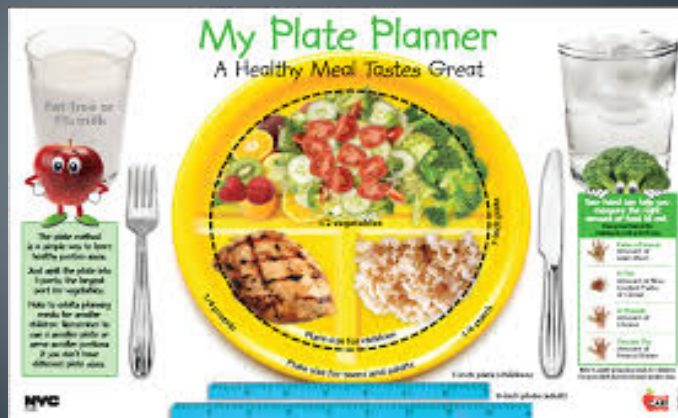

Treatment

- EAT REAL FOOD
  - No trans Fats
- Whole Grains
- Veggies!! Fruits!!
- Lean Protein
  - Skinless chicken, cold water fatty fish
  - Eggs
  - Increase legumes, nuts
- Good fats like polyunsaturated and monounsaturated
  - Avocado, olive oil

Treatment

Gender	Age (Years)	Calorie Requirements (kcals) by Activity Level[b]		
		Sedentary	Moderately Active	Active
Child	2–3	1000–1200	1000–1400[c]	1000–1400[c]
Female[d]	4–8	1200–1400	1400–1600	1400–1800
	9–13	1400–1600	1600–2000	1800–2200
	14–18	1800	2000	2400
	19–30	1800–2000	2000–2200	2400
Male	4–8	1200–1400	1400–1600	1600–2000
	9–13	1600–2000	1800–2200	2000–2600
	14–18	2000–2400	2400–2800	2800–3200
	19–30	2400–2600	2600–2800	3000

Treatment

Treatment

- Exercise recommendations for children and teens 5-17
- Moderate to vigorous activity 1 hour a day (can talk but not sing)
- Vigorous intensity physical activity 2-3 days/week (can only say a few words)

Treatment

- How to react to overweight numbers for children
- Overweight children should be seen at least quarterly with both dietician visit for both child and family (*)
- Obese children should be seen monthly
- Ask family to reduce weight-related talk at home

Treatment

6-10 Years Message
5: Eat FIVE fruits and veggies a day.
4: Give and get FOUR compliments a day.
3: Consume THREE dairy a day.
2: No more than TWO media hours a day.
1: At least ONE hour of exercise a day.
0: NO sugar-sweetened drinks, ever.
GO: Be well, inside and out!
11 Years +
5: Eat FIVE fruits and veggies a day.
4: Consume FOUR dairy a day.
3: Give and get THREE compliments a day.
2: No more than TWO media hours a day.
1: At least ONE hour of exercise a day.
0: NO sugar-sweetened drinks, ever.
GO: Be well, inside and out!

Other Considerations

- Be careful and sensitive with delivery of dietary recommendations
- Possible to trigger restrictive "dieting" habits that can lead to Anorexia Nervosa
- Binge Eating Disorder
- Fad Diets
- Vegetarian/Vegan